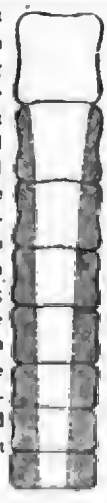
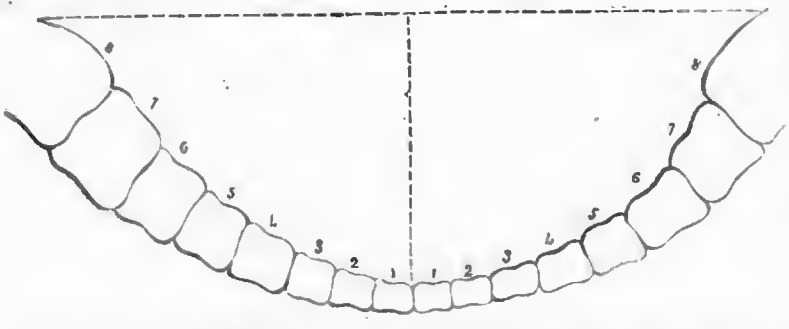
evident that besides the great waste of material which would be caused by making the lowest of the vertebræ of the same size and weight as the eighth, the eighth would have to carry all that additional weight, and would therefore be much weaker for the purpose. Thus, there may be cases in which materials more than threefold would be consumed; and the eighth of the vertebræ having consequently more than threefold burthen to sustain, the effective strength thus resulting from the materials would be less than a ninth part of that which it naturally should be.

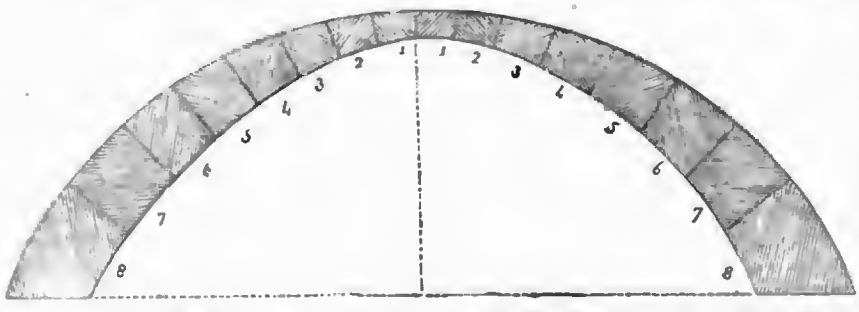


Hence, in suspension-bridges, the chains ought to be thinner in their middle than at the suspension-towers, as practised in Dredge's mode. Great consumption of metal is thus saved, the chains are much more safe and much less likely to break near the suspension-towers, lighter suspension-towers are sufficient, and the foundation of the work is safer, from being much less tried by burthen.

The same rule applies to masonry bridges of the catenarian form, by merely changing the tension of the catenary into the pressure of the voussoirs upon each other; in which case the surfaces of the arch-joints should continually increase in dimension as they recede from the vertex of the arch, so that there may be the same pressure upon every inch of joint-surface throughout the work.



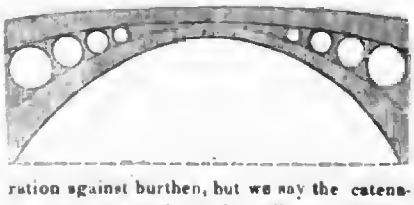
But now comes the burthen of the bridge; and upon that subject we boldly say that many bridges have been formed upon false, wasteful, and ruinous theories; for, abstractly, no bridge ought to have on its piers and arches any burthen whatever other than the mere materials



requisite for catenarian construction, with the simple addition of its roadway and traffic.

It is that burthen which costs money,—it is that burthen which occasions excess of dimension in the piers,—and finally, it is that burthen which causes ruin to the work by sinking in its foundation.

The practical man may start at this decla-



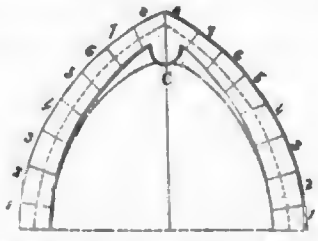
ration against burthen, but we say the catenarian vertebræ ought to be split apart or distended, so as to form the line of roadway above and the arch curvature below.

William Edwards, the Welsh country mason, a hundred years ago, made considerable approaches to this perfection of construction, in his bridge of Pont-y-Pridd, over the Taff, the arch of which, though rising only thirty-five feet, has a span of one hundred and forty feet. This bridge is only eleven feet wide; it is, indeed, a stiffened stone rope, proportioned like two animal tails, united at their inferior ends, and distended at their other ends to the forms of the arch and roadway.

As bridges have mostly parallel sides, the increase of the surfaces of the voussoirs being restricted that way, the raising of the spandrils to the form of the roadway is the more readily managed.

But great art is requisite in forming the masonry-joints of such a work; and this, we believe, has never yet been perfectly effected: on a future occasion, however, we may go a little into the subject.

The ancient Freemasons appear to have been intimately acquainted with the catenarian principle of construction, as we shall also take occasion hereafter to shew. They found that they could nearly imitate the form of the chain-curve, by drawing, with little trouble, with the compasses, a pointed arch; but, knowing that a weight appended from the centre of the catenary [C *in the annexed diagram*] draws it still more nearly into the form of the pointed arch: when they reversed the curvature and put it into absolute work, they added to the vertex



of the arch a weight, which they usually carved into the form of an ornamental boss.

Want of space compels us here to break off the subject, which we shall resume in our next number.

WESTMINSTER BRIDGE.

Some statements having lately appeared relative to the present condition of Westminster-bridge calculated to induce doubts of its safety, we have ascertained the real and actual condition of the structure in question.

It appears that after the steps which Mr. Walker had taken to improve and secure the foundations of the bridge, the sixth arch on the Surrey side was observed to settle, both in its pier and its superstructure; and this sinking continued from time to time during the space of nearly eight months, when it at last ceased, and for the last three months has remained stationary without any further alteration of its level.

Upon an investigation into the extent to which this settlement had gone, and of the causes which led to it, it was found that the pier itself had sunk bodily about nine inches, and that even the new extension of the pier, which was founded upon concrete carried down to the level of the blue clay, had participated in the settlement, without, however, affecting the solidity of the pier itself, or, as far as it can be ascertained, of the piling with which it was surrounded, which latter, it seems, still remains perfect and uninjured.

The consequences of such settlement were, that four of the larger masonry courses or arch stones fell some four inches, so that they projected slightly below the curve line described by the under surface of the arch itself.

The steps taken to remedy these evils have been to lower the roadway over the bridge generally, more especially over that part which had given way; the superincumbent load on which was further lightened to the extent of 2,000 tons, by removing the solid superstructure and substituting in its place a series of hollow brick arches.

The injury done to the arch itself was repaired by withdrawing the stones or courses which had become displaced, and replacing them with others; in fact, re-keying the arch by stones adjusted to the altered level occasioned by the settlement of the sunken piers.

That these steps have been perfectly efficacious, is proved by the fact that no further settlement has taken place within these last three months, the foundations of the piers having become completely settled and stationary. The masonry remains perfectly solid, and although the bridge has been opened now upwards of four weeks, and the traffic over it has been immense, not the slightest vibration or alteration of level can be detected; and for any thing at present apparent, the bridge is more firm and solid than ever, and will most likely (if permitted) remain in its present state for ages.

It should here also be remarked that the sinking was almost entirely confined to this one pier (the sixth from the Surrey side); and that the reason so little has been done in the repair of the bridge since Christmas is, that the Commissioners have adopted the recommendation of the engineer to suspend the works during the winter months.

When the works which are now contemplated shall be finished, it is clear that the public will derive great advantage from them,